

What is claimed is:

1. A dental imaging system, comprising:
 - a handpiece including a handle portion and a distal end portion, said distal end portion having a view port for viewing intra- and extra-oral dental anatomy;
 - an optical system mounted in said distal end portion of said handpiece, said optical system being configured to acquire, orient and transmit an image of said dental anatomy appearing in said view port;
 - a sensor assembly mounted in said distal end of said handpiece, said sensor assembly being configured to convert images received through said optical system into video data signals;
 - a camera control unit mounted in said handle portion of said handpiece, said camera control unit being configured to receive said video data signals from said sensor assembly and to generate video output signals of said image from said video data signals; and
 - an interface means connected to said camera control unit for providing power to said camera control unit and for receiving video output signals from said camera control unit for transmission to a device for display or further processing.
2. The dental imaging system of claim 1 where said interface means comprises a utility cable, said utility cable connecting said handpiece to one of an interface unit and a docking station, said utility cable comprises a camera cable having first cable components to convey said power to said camera control unit from said one of an interface unit and a docking station and second cable components to convey said video output signals from said camera control unit to said one of an interface unit and a docking station.
3. The dental imaging system of claim 2 wherein said second cable components comprise conductors to convey one of S-video signals, composite video signals and digital video signals.
4. The dental imaging system of claim 3 wherein said second cable components comprise conductors to convey S-video signals.

5. The dental imaging system of claim 2 wherein said utility cable further comprises a fiber optic light guide to transmit light from said one of an interface unit and a docking station to said handpiece.

6. The dental imaging system of claim 2 wherein said camera cable comprises third cable components to convey control signals to said camera control unit from said one of an interface unit and a docking station.

7. The dental imaging system of claim 1 wherein said interface means comprises a battery to supply power to said camera control unit.

8. The dental imaging system of claim 1 wherein said interface means comprises a wireless transmission system to transmit said video output signals from said camera control unit to a remote receiver.

9. The dental imaging system of claim 1 wherein said interface means are detachably connected to said handpiece.

10. The dental imaging system of claim 1 further comprises an illumination source.

11. The dental imaging system of claim 10 wherein said illumination source comprises a lamp, a reflector and a lens.

12. The dental imaging system of claim 11 wherein said handpiece further comprises a light guide to receive light from said lens and transmit said light to said distal end portion of said handpiece.

13. The dental imaging system of claim 10 wherein said illumination source comprises at least one light emitting diode.

14. The dental imaging system of claim 1 further comprising one of an interface unit and a docking station to receive said video output signals from said camera control unit.

15. The dental imaging system of claim 1 further comprising:
a connector to flexibly interconnect said camera control unit with said sensor assembly; and

a connector to flexibly interconnect said interface means and said camera control unit circuit.

16. The dental imaging system of claim 15 wherein:

said connector to flexibly interconnect said camera control unit with said sensor assembly comprises a flexible printed circuit; and

said connector to flexibly interconnect said interface means and said camera control unit comprises a flexible printed circuit.

17. The dental imaging system of claim 16 wherein said flexible printed circuit to interconnect said camera control unit with said sensor assembly is positioned in an elongated loop to permit axial adjustment of said sensor assembly for focusing on said dental anatomy.

18. The dental imaging system of claim 15 wherein said connector to flexibly interconnect said camera control unit with said sensor assembly comprises an extension board rigidly connected to said camera control unit and said sensor assembly such that said camera control unit and said sensor assembly are axially adjustable in tandem for focusing said sensor assembly upon said dental anatomy.

19. The dental imaging system of claim 1 wherein said video output signals from said camera control unit comprise one of S-video signals, composite video signals and digital video signals.

20. The dental imaging system of claim 1 wherein said camera control unit comprises one of a digital signal processor and an analog signal processor.

21. The dental imaging system of claim 1 wherein said sensor assembly comprises one of a charge coupled device, a CMOS device and an active pixel sensor.

22. The dental imaging system of claim 1 wherein said sensor assembly is axially adjustable into a plurality of predetermined focus modes to focus on said dental anatomy.

23. The dental imaging system of claim 22 wherein each of said plurality of predetermined focus modes is selected by adjusting a ring in said handle region of said handpiece, said ring being operatively connected to an assembly for axial adjusting said sensor assembly

such that an adjustment in said ring results in said assembly axially adjusting said sensor assembly to correspond to a predetermined focus mode.

24. The dental imaging system of claim 1 wherein a plurality of predetermined focus modes are selected by adjusting a ring in said handle region of said handpiece, said ring being operatively connected to an assembly for axial adjusting at least one element of said optical system relative to said sensor assembly such that an adjustment in said ring results in said assembly axially adjusting said at least one element of said optical system to correspond to a predetermined focus mode.

25. The dental imaging system of claim 1 wherein said handpiece comprises a conical section between said handle portion and said distal end portion, said conical section having plurality of orientation dimples spaced circumferentially about said conical section, wherein holding said conical section of said housing with an index finger positioned in an orientation dimple orients said view port in a pre-selected viewing direction.

26. The dental imaging system of claim 2 wherein said optical system comprises:
a window to acquire said image of said dental anatomy;
a prism to reflect said image of said dental anatomy acquired from said window;
and
a lens assembly to transmit said image of said dental anatomy received from said prism to said sensor assembly.

27. The dental imaging system of claim 26 wherein said optical system further comprises a negative lens.

28. The dental imaging system of claim 26 wherein said prism is a non-inverting prism.

29. A camera handpiece for a dental imaging system, said camera handpiece comprising:

a housing including a handle portion and a distal end portion, said distal end portion having a view port for viewing intra- and extra-oral dental anatomy;

an optical system mounted in said distal end portion of said housing, said optical system being configured to acquire and transmit an image of said dental anatomy appearing in said view port;

a sensor assembly mounted in said distal end of said housing, said sensor assembly being configured to convert images received through said optical system into video data signals;

a camera control unit mounted in said handle portion of said housing, said camera control unit being configured to receive said video data signals from said sensor assembly and to generate video output signals of said image from said received video data signals; and

an interface means connected to said camera control unit for providing power to said camera control unit and for receiving video output signals from said camera control unit for transmission to a device for display or further processing.

30. The camera handpiece of claim 29 wherein said interface means further comprises means for conveying control signals to said camera control unit.

31. The camera handpiece of claim 30 wherein the interface means comprises a cable interface to connect a utility cable to said camera handpiece.

32. The camera handpiece of claim 31 wherein said cable interface is configured to provide a detachable connection between said utility cable and said camera handpiece.

33. The camera handpiece of claim 29 wherein said interface means comprises a battery to supply power to said camera control unit.

34. The camera handpiece of claim 29 wherein said interface means comprises a wireless transmission system to transmit said video output signals from said camera control unit to a remote receiver.

35. The camera handpiece of claim 34 wherein said wireless transmission system comprises a transmitter and an antenna.

36. The camera handpiece of claim 29 further comprises an illumination source.

37. The camera handpiece of claim 36 wherein said illumination source comprises a lamp, a reflector and a lens.

38. The camera handpiece of claim 37 further comprises a light guide to receive light from said lens and transmit said light to said distal end portion of said handpiece.

39. The camera handpiece of claim 36 wherein said illumination source comprises at least one light emitting diode.

40. The camera handpiece of claim 29 further comprising:
a connector to flexibly interconnect said camera control unit with said sensor assembly; and
a connector to flexibly interconnect said interface means and said camera control unit.

41. The camera handpiece of claim 40 wherein:
said connector to flexibly interconnect said camera control unit with said sensor assembly comprises a flexible printed circuit; and
said connector to flexibly interconnect said interface means and said camera control unit comprises a flexible printed circuit.

42. The camera handpiece of claim 41 wherein said flexible printed circuit to interconnect said camera control unit with said sensor assembly is positioned in an elongated loop to permit axial adjustment of said sensor assembly for focusing on said dental anatomy.

43. The camera handpiece of claim 40 wherein said connector to flexibly interconnect said camera control unit with said sensor assembly comprises a rigid connection between said camera control unit and said sensor assembly such that said camera control unit and said sensor assembly are axially adjustable in tandem for focusing said sensor assembly upon said dental anatomy.

44. The camera handpiece of claim 29 wherein said video output signals from said camera control unit comprise one of S-video signals, composite video signals and digital video signals.

45. The camera handpiece of claim 29 wherein said sensor assembly comprises one of a charge coupled device, a CMOS device and an active pixel sensor.

46. The camera handpiece of claim 29 wherein said camera control unit comprises one of a digital signal processor and an analog signal processor.

47. The camera handpiece of claim 29 wherein said sensor assembly is axially adjustable into a plurality of predetermined focus modes to focus on said dental anatomy.

48. The camera handpiece of claim 47 wherein each of said plurality of predetermined focus modes is selected by adjusting a ring in said handle region of said housing, said ring being operatively connected to an assembly for axial adjusting said sensor assembly such that an adjustment in said ring results in said assembly axially adjusting said sensor assembly to correspond to a predetermined focus mode.

49. The camera handpiece of claim 29 wherein said housing comprises a conical section between said handle portion and said distal end portion, said conical section having plurality of orientation dimples spaced circumferentially about said conical section, wherein holding said conical section of said housing with an index finger positioned in an orientation dimple orients said view port in a pre-selected viewing direction.

50. The camera handpiece of claim 29 wherein said optical system comprises:
a window to acquire said image of said dental anatomy;
a prism to reflect said image of said dental anatomy acquired from said window;
and
a lens assembly to transmit said image of said dental anatomy received from said prism to said sensor assembly.

51. The camera handpiece of claim 50 wherein said optical system further comprises a negative lens.

52. The camera handpiece of claim 50 wherein said prism is a non-inverting prism.

53. The camera handpiece of claim 50 wherein:
said prism is an inverting prism; and

said camera control unit comprises orienting circuitry to orient said image received from said sensor assembly.

54. The camera handpiece of claim 29 wherein said camera control unit comprises a non-volatile memory to store control instructions for said camera control unit.

55. The camera handpiece of claim 29 wherein a plurality of predetermined focus modes are selected by adjusting a ring in said handle region of said housing, said ring being operatively connected to an assembly for axial adjusting at least one element of said optical system relative to said sensor assembly such that an adjustment in said ring results in said assembly axially adjusting said at least one element of said optical system to correspond to a predetermined focus mode.

56. A dental imaging system, comprising:

a handpiece including a handle portion and a distal end portion, said distal end portion having a view port for viewing intra- and extra-oral dental anatomy;

an optical system mounted in said distal end portion of said handpiece, said optical system being configured to acquire, orient and transmit an image of said dental anatomy appearing in said view port;

a sensor assembly mounted in said distal end of said handpiece, said sensor assembly being configured to convert images received through said optical system into video data signals;

a camera control unit mounted in said handle portion of said handpiece, said camera control unit being configured to receive said video data signals from said sensor assembly and to generate video output signals of said image from said video data signals; and

a docking station connected to said camera control unit, said docking station being configured to provide power and control signals to said camera control unit and to receive video output signals from said camera control unit for display or further processing.

57. The dental imaging system of claim 56 further comprising a utility cable to connect said handpiece and said docking station, said utility cable comprises a camera cable having first cable components to convey said power and control signals to said camera control unit from said docking station and second cable components to convey said video output signals

from said camera control unit to said docking station, and said utility cable further comprising a fiber optic light guide to transmit light from said interface unit to said handpiece.

58. The dental imaging system of claim 57 further comprising:
a flexible printed circuit to flexibly interconnect said camera control unit circuit with said sensor assembly; and
a flexible printed circuit to flexibly interconnect said camera cable and said camera control unit circuit.

59. The dental imaging system of claim 56 wherein said sensor assembly is a charge coupled device.

60. The dental imaging system of claim 56 wherein said sensor assembly is axially adjustable into a plurality of predetermined focus modes to focus on said dental anatomy and each of said plurality of predetermined focus modes is selected by adjusting a ring in said handle region in said handpiece.

61. The dental imaging system of claim 56 wherein said handpiece comprises a conical section between said handle portion and said distal end portion, said conical section having plurality of orientation dimples spaced circumferentially about said conical section, wherein holding said conical section of said handpiece with an index finger positioned in an orientation dimple orients said view port in a pre-selected viewing direction.

62. The dental imaging system of claim 56 wherein said camera control unit comprises a digital signal processor and means for generating a video output signal in an S-video format.

63. The dental imaging system of claim 56 wherein said optical system comprises:
a window to acquire said image of said dental anatomy;
a negative lens to pass a narrow angle image of said acquired image;
a non-inverting prism to reflect said narrow angle image of said dental anatomy passed by said negative lens; and
a lens assembly to transmit said narrow angle image of said dental anatomy received from said prism to said sensor assembly.

64. A camera handpiece for a dental imaging system, said camera handpiece comprising:

- a housing including a handle portion and a distal end portion, said distal end portion having a view port for viewing intra- and extra-oral dental anatomy;

- an optical system mounted in said distal end portion of said housing, said optical system being configured to acquire and transmit an image of said dental anatomy appearing in said view port;

- a sensor assembly mounted in said distal end of said housing, said sensor assembly being configured to convert images received through said optical system into video data signals;

- a camera control unit mounted in said handle portion of said housing, said camera control unit being configured to receive said video data signals from said sensor assembly and to generate video output signals of said image from said received video data signals; and

- a cable interface to connect a utility cable to said camera handpiece.

65. The camera handpiece of claim 64 further comprising:

- a flexible printed circuit to flexibly interconnect said camera control unit circuit with said sensor assembly; and

- a flexible printed circuit to flexibly interconnect said cable interface and said camera control unit circuit.

66. The camera handpiece of claim 64 wherein said sensor assembly is a charge coupled device.

67. The camera handpiece of claim 64 wherein said sensor assembly is axially adjustable into a plurality of predetermined focus modes to focus on said dental anatomy and each of said plurality of predetermined focus modes is selected by adjusting a ring in said handle region in said handpiece.

68. The camera handpiece of claim 64 wherein said handpiece comprises a conical section between said handle portion and said distal end portion, said conical section having plurality of orientation dimples spaced circumferentially about said conical section, wherein holding said conical section of said handpiece with an index finger positioned in an orientation dimple orients said view port in a pre-selected viewing direction.

69. The camera handpiece of claim 64 wherein said camera control unit comprises a digital signal processor and means for generating a video output signal in an S-video format.

70. The camera handpiece of claim 64 wherein said optical system comprises:
a window to acquire said image of said dental anatomy;
a negative lens to pass a narrow angle image of said acquired image;
a non-inverting prism to reflect said narrow angle image of said dental anatomy passed by said negative lens; and
a lens assembly to transmit said narrow angle image of said dental anatomy received from said prism to said sensor assembly.